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*Preliminary Investigation of Soft
Tissue Injuries in Workplaces in
Waterloo-Wellington Counties*

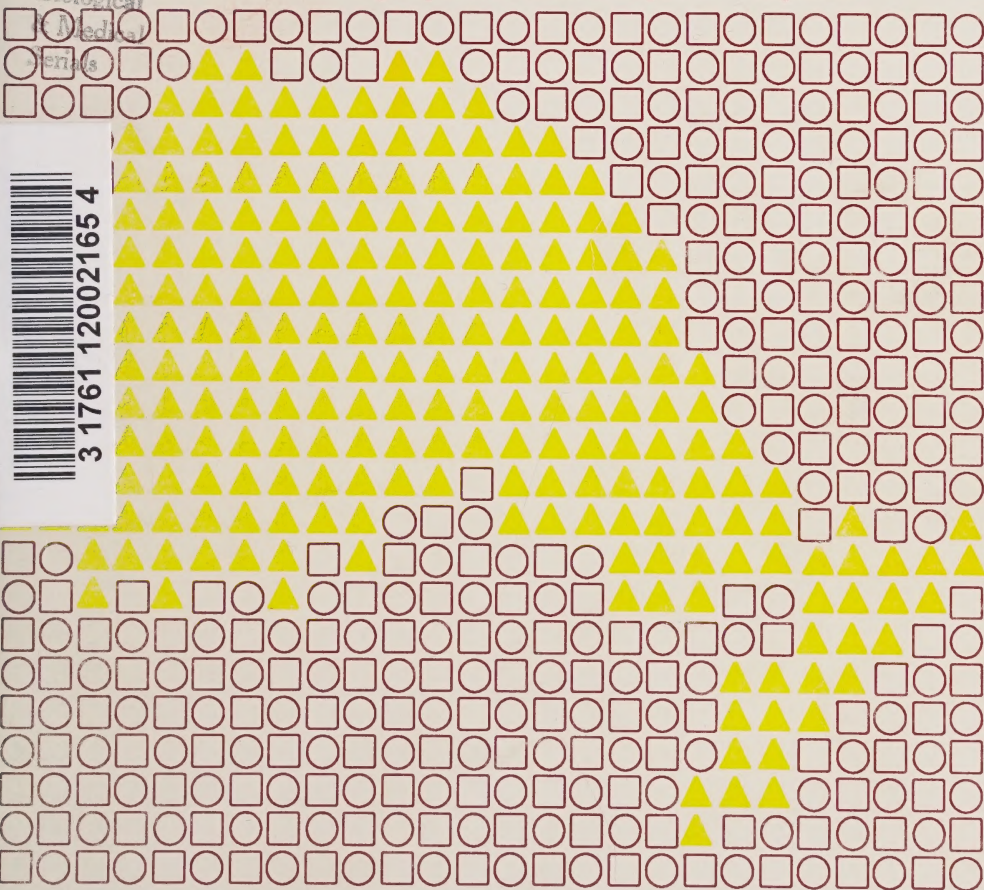
Mesothelioma

*Assessment of Respiratory
Impairment in
Silica and Asbestos
Exposure*

*Identification and Management
of Depression in the Workplace*

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Preliminary Investigation of Soft Tissue Injuries in Workplaces in Waterloo-Wellington Counties

Summary

Thirty-one workplaces with high incidences of compensable workplace injuries were visited to discuss the prevention and management of soft tissue injuries. The percentage of claims due to soft tissue injuries in these workplaces ranged from 35 per cent to 100 per cent. Statistics were compiled regarding union affiliation, job ownership, shifts and shift rotation, incentive plans, accident investigation procedures, fitness-to-work examinations, training programs, occupational health programs and modified work programs.

Key Words: soft tissue injury, repetitive strain injury

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Background

From October 1990 to April 1991, 31 industries in Waterloo-Wellington counties with high incidences of compensable workplace injuries/illnesses, particularly soft tissue injuries, as identified in the Workers' Compensation Board statistics, were visited by the Ministry of Labour nurse consultant. Industries included a diverse selection of manufacturing firms and one large grocery chain.

The objectives of the nurse consultant's visits were as follows:

1. To draw the company's attention to the Workers' Compensation Board data on the incidence of soft tissue injuries.
2. To advise the company regarding the identification of work processes that may result in such injury.
3. To advise the company on record keeping and the development of statistics pertinent to soft tissue injuries.
4. To stress the importance of workers' education regarding the prevention of soft tissue injuries.
5. To document actions taken by the company in reducing the incidence of soft tissue injuries.
6. To make appropriate referrals to the Ministry of Labour ergonomic consultant.
7. To identify common issues and trends that may be associated with the incidence of soft tissue injuries in these companies.

Soft tissue injuries included sprains, strains, back injuries and hernias. The protocol found in the Ministry of Labour's Consultant Guidance Notes, ('Occupational Health Nurses and Ergonomic Programs') was used for each visit.

Procedure

Further research is indicated to determine the effects of shift work and shift rotation and incentive programs as well as the cost effectiveness of fitness-to-work examinations and occupational health programs.

Thirty manufacturing firms and one large grocery chain were selected from Workers' Compensation Board forms (LISBMR 56) for Waterloo and Wellington counties. Each of the companies selected indicated an above-average frequency of occupational injuries/illnesses for its specific rate group. Approved Workers' Compensation Board claim information for the year 1989, as found in form LISBMR 98, was requisitioned from the board and analysed prior to visiting each firm. All 31 companies were visited by the same Ministry of Labour nurse consultant from October 1990 to April 1991. During each visit, data were collected as indicated in the above protocol, and advice and information were provided regarding record keeping and statistics, physical demands analysis, work task analysis, fitness-to-work examinations, training programs, modified work programs, and accident investigation pertinent to soft tissue injuries.

Three months following the mailing/delivery to the company of the nurse consultant's report, a follow-up letter (see Appendix A at the end of this study) and questionnaire (Appendix B) were sent to each firm.

Results and Discussion

Companies visited varied in size from 5 to 5,500 production workers (Table 1). There was no identified relationship between the size of the company and the percentage of claims and total lost days due to soft tissue injuries.

Twenty-one of the workplaces visited were unionized, with 11 including job ownership in the union contract. Two non-unionized workplaces also provided job ownership. Workplaces with job ownership provisions indicated considerable difficulty in initiating job rotation and in providing modified work for injured or ill employees.

Table 1 Soft Tissue Injury Statistics and Related Information for Selected

Co.	Production Workers				WCB Claims		Lost Days	
	< 50	51-100	101-200	> 200	Total	%STI	Total	% STI
1		X			96	56	1255.5	55
2				X	89	64	2440	76
3				X	76	50	960	76
4				X	50	54	725.5	80
5			X		74	69	1651.5	84
6			X		51	70.5	716	84
7	X				6	83	143	99
8		X			25	72	920	64
9		X			9	55	410.5	94
10		X			34	44	685	69
11		X			22	45	430	38
12				X	276	53	3556.5	76
13				X	26	90	898	90
14		X			50	68	517	72
15	X				31	58	269	74
16		X			21	76	273	72
17		X			20	55	444	72
18		X			15	40	170.5	23
19		X			24	50	666	60
20	X				23	43	351	53
21				X	7	43	84	83
22				X	56	62.5	2105.5	88
23	X				21	62	460.5	60
24	X				20	35	209	29
25	X				1	100	6	100
26			X		57	38.5	463	51
27	X				6	83	77	78
28		X			9	44	113	61
29		X			16	69	106	72
30			X		11	82	163	85
31		X			11	64	47	85

STI: Soft Tissue Injuries

Incentive Schemes:

PW: Piecework

G: Group

PS: Profit Sharing

Companies in Waterloo-Wellington Counties: January 1989 - December 1989

Incentive Schemes				Ergon. Assess.		Physical Demands Analysis			Fitness-to-Work Exams			Job Rotation		OH Program		Accident Invest.	
No	PW	G	PS	Y	N	Y	N	ST	Y	N	GM	Y	N	Y	N	Y	N
		X			X		X			X			X	X		X	
	X				X		X				X		X	X		X	
X				X		X					X	X		X		X	
X				X				X		X			X		X	X	
			X	X				X	X				X	X			X
			X		X					X		X			X	X	
X				X						X			X		X		X
	X	X			X		X			X			X		X		X
	X				X		X				X		X		X	X	
X					X		X				X	X			X	X	
			X	X		X			X				X		X	X	
X					X		X			X			X		X	X	
X					X			X			X	X		X		X	
X					X						X	X		X		X	
	X				X		X				X				X	X	
X					X		X				X				X	X	
		X			X		X				X				X	X	
			X		X			X			X				X	X	
BONUS						X		X				X	X			X	X
X				X			X				X	X	X		X	X	
X					X		X			X		X			X		X
X					X		X				X	X			X	X	
BONUS						X		X			X		X			X	X
	X	X			X		X			X		X			X	X	
X					X		X			X			X		X	X	
X					X		X			X		X			X	X	
			X		X		X			X			X		X	X	
	X				X		X			X			X		X	X	
X					X		X			X		X			X	X	

Physical Demands Analysis:
 ST: Started
 Fitness-to-Work Exams:
 GM: General Medical Examination
 OH Program: Occupational Health Program

Table 2**Shift Work and Shift Rotation**

Shift	Number of Companies	Number of Companies with Shift Rotation
1 8-hr. day	14	
1 8-hr. day; 1 10-hr. evening	7	4
3 8-hr. shifts	6	2
2 8-hr. shifts	2	1
2 12-hr. shifts	1	1
1 8-hr. day; 2 10-hr. shifts	1	0
Total	31	8

Table 3**Relationship of Workers' Compensation Statistics to Hours of Work and Shift Work**

Shift Work	% of STI & WCB Claims		% of STI of Total Lost Days	
	Range	Average	Range	Average
1 8-hr. day	35 – 100%	58%	23 – 100%	70%
Shift work: no rotation	38.5 – 76%	62%	51 – 88%	69%
Shift work: rotation	44 – 90%	64%	55 – 90%	75%

STI: soft tissue injury

Hours of work varied from one eight-hour day shift in 14 companies to a variety of shifts in the remaining 17 firms (see Table 2). In the 8 companies with rotating shifts, the frequency of rotation varied from every three days to every five weeks. The range of the percentage of claims and lost days due to soft tissue injuries was slightly higher for the companies with shift rotation (Table 3); however, considering the small number of companies visited, it would be impossible to predict any valid relationship between the incidence of soft tissue injuries and shift rotation.

In the majority of firms visited, there were two 10- or 15-minute breaks and a 30-minute lunch break. Breaks provided in the remaining firms varied from two 15-minute breaks per shift to two 15-minute breaks and a one-hour lunch break per shift. No relationship was apparent between the number and lengths of breaks and Workers' Compensation Board statistics.

There were no incentive schemes in place in 15 workplaces. Four workplaces had profit-sharing plans; 4 provided group incentives; and 2 provided a company-wide bonus for above-average production. Workers were paid by piecework in 6 firms visited.

Companies with group incentive schemes indicated that injured/ill workers returning to the workplace on modified work were not assigned jobs within the incentive program. The workers were thus able to avoid pressure from coworkers to maintain high production levels.

The percentage of Workers' Compensation claims due to soft tissue injuries in workplaces where workers were paid by piecework ranged from 50 per cent to 82 per cent, and the percentage of total lost days ranged from 60 per cent to 94 per cent; these rates compare with 35 per cent to 100 per cent and 23 per cent to 100 per cent, respectively, for all workplaces visited. (See tables 3 and 4.)

Table 4

Relationship of Workers' Compensation Statistic and Piecework

Company	WCB Claims		Lost Days	
	Total	% STI	Total	% STI
2	89	64	2440	76
8	25	72	2920	64
9	9	55	410.5	94
15	31	58	269	74
19	24	50	666	60
30	11	82	16.3	85
Average		63.5		75.5

STI : soft tissue injury

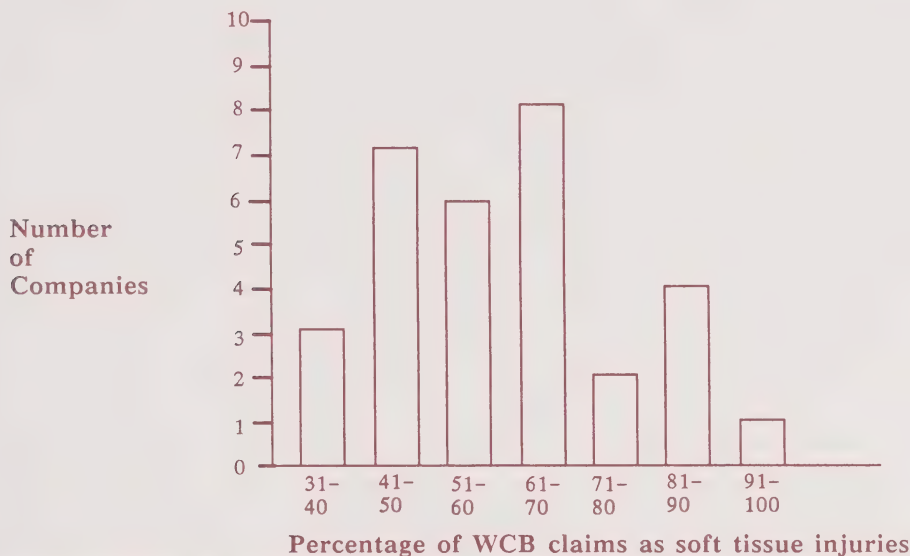
In 24 companies, overtime was voluntary. In the remaining 7 companies, workers were required by union contract to work up to 8 hours overtime if there were insufficient volunteers. In 14 firms, overtime was offered on the basis of seniority and job classification. In the remaining firms, overtime was equally distributed among interested workers.

In 8 of the firms visited (26 per cent), the percentage of Workers' Compensation claims due to soft tissue injuries was below 50 per cent. In 2 of the firms, 50 per cent of total claims were due to soft tissue injuries. In the remaining 21 companies (68 per cent), soft tissue injuries accounted for over 50 per cent of total claims (Figure 1).

In only 3 firms visited (10 per cent), the percentage of total lost days due to repetitive strain injuries was below 50 per cent. In 28 firms (90 per cent), the percentage of total lost days due to soft tissue injuries exceeded 50 per cent. In 20 firms (65 per cent), they exceeded 70 per cent, and in 10 (32 per cent) they exceeded 80 per cent (Figure 2).

Figure 1

**Workers' Compensation Claims:
Percentage Soft Tissue Injuries**



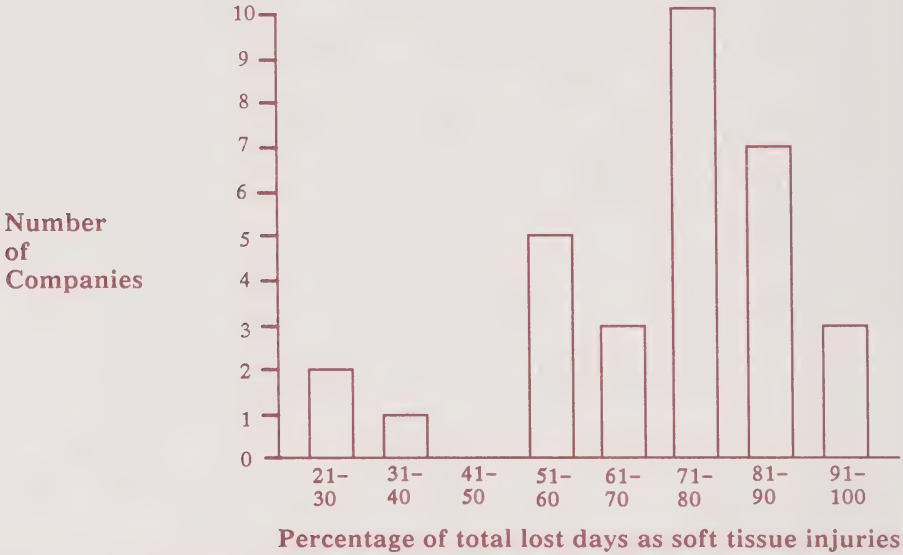
If the percentage of Workers' Compensation claims and the percentage of total lost days due to soft tissue injuries in these firms can be projected to all manufacturing firms, it clearly indicates that soft tissue injuries are a major workplace problem.

An ergonomic assessment was completed in 7 of the 31 companies visited (Table 1). The percentage of Workers' Compensation claims due to soft tissue injuries in these firms ranged from 43 per cent to 83 per cent, and the percentage of total lost days from 38 per cent to 99 per cent.

Two of the firms visited had completed physical demands analyses for jobs throughout the workplace. Four others had started to conduct physical demands analyses. The remaining 25 workplaces had not initiated these analyses.

Figure 2

Workers' Compensation Total Lost Days:
Percentage Soft Tissue Injuries



Two companies provided fitness-to-work examinations for new employees. In 9 companies, new workers were required to undergo a general medical examination, and in the remaining 20 companies new workers were not medically assessed.

In 14 of the companies visited, workers rotated jobs; however, jobs in the rotation schedule frequently involved similar work tasks and the use of the same muscle groups. The data collected showed no significant differences in the percentage of Workers' Compensation claims and total lost days due to repetitive strain injury in workplaces with job rotation compared with workplaces with no rotation.

Only one company visited offered a training program (consisting of a video presentation) pertinent to the prevention of repetitive strain injuries.

Only three firms provided a full-time occupational health service and two firms contracted the services of a part-time occupational health nurse; consequently, it was not possible to determine the effectiveness of an occupational health service in reducing the frequency and severity of soft tissue injuries.

Despite the implementation of Workers' Compensation Board Bill 162 on January 1, 1990, 10 of the 31 companies visited had not established a modified work program. The majority of firms visited were not familiar with specialists such as the worksite analyst and modified work specialist available from the Workers' Compensation Board.

Four of the firms visited reported that an accident investigation was not initiated for soft tissue injury claims because these problems arise out of the normal course of employment, and therefore there is nothing to investigate.

In the majority of the remaining firms, the accident investigation form indicated the following: regular job, no specific incident. In the majority of cases, preventive measures were not documented and had not been identified or considered.

Ten of the 34 follow-up questionnaires were returned. Nine of 10 responding firms indicated that statistics had been developed to relate specific injuries to specific jobs or work processes. Three firms had initiated an ergonomic assessment. Three firms had completed physical demands analyses for jobs in their workplaces, and 5 firms had initiated such analyses. Six firms indicated the identification of preventive measures. Two firms had initiated training programs, and 4 firms were planning programs pertinent to the prevention of repetitive injuries and back injuries (four meetings, two manuals, two video presentations). Three firms indicated that modifications had been made to jobs or work processes, and 3 firms had initiated job rotation schedules.

Conclusions

The data collected indicate that soft tissue injuries are a major contributor to the number and severity of workplace injuries/illnesses in a wide range of industries in Waterloo–Wellington counties.

Employers need assistance with record keeping, the development of meaningful statistics, and the identification of jobs and work processes associated with high incidences of soft tissue injuries.

Increased emphasis needs to be put on the training of all workplace parties in the prevention of soft tissue injuries as well as on the value of ergonomic assessments and appropriate modifications in work processes. A great need exists for readily available, low-cost, effective training programs.

Currently available accident-investigation training programs should provide more in-depth information regarding the investigation of soft tissue injury trends or patterns, and the importance of identifying preventive measures.

Resources available to assist workplace parties with the prevention and management of soft tissue injuries should be publicized so that these resources can be used fully and appropriately.

Further research regarding the effect of shift work, shift rotation and incentive programs on the incidence and severity of soft tissue injuries as well as the cost-effectiveness of fitness-to-work examinations and occupational health programs may lead to some innovative solutions.

Résumé

L'auteur a visité trente-et-un lieux de travail à forte incidence de blessures professionnelles indemnifiables, afin de discuter de la prévention et de la gestion des blessures des tissus mous. Le pourcentage de demandes d'indemnisation dues à des blessures des tissus mous dans ces lieux de travail variait de 35 à 100 %. L'auteur a préparé des données statistiques sur la syndicalisation, la propriété des emplois, l'écart et le roulement d'écart, les régimes incitatifs, les modalités

d'enquête sur les accidents, les examens d'employabilité, les programmes de formation et l'hygiène professionnelle, ainsi que les programmes de travail modifié. D'après les résultats, il faut aider les employeurs à préparer des données statistiques significatives, des programmes de formation, des modalités d'enquête sur les accidents et des programmes de tâches modifiées. Des recherches supplémentaires s'imposent, afin de préciser l'effet du travail par quarts et des programmes incitatifs, ainsi que la rentabilité des examens d'employabilité et des programmes d'hygiène professionnelle.

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Workers' Compensation Board of Ontario.
Modified Work Program Guide. Toronto: the
Board, March 1990.

Appendix A

Follow-up Letter to Firms Three Months After
the Mailing of Consultant Assessment Report

Date:

To:

Reference: [Professional and Specialized Services Program]
Consultant Report No.

A visit was made to your firm and the subject report was issued concerning the
occurrence of soft tissue injuries in the workplace.

Would you please advise this office at your earliest convenience of your firm's
response to the advice and recommendations contained in the subject report and
complete the attached general questionnaire.

Thank you for your cooperation.

Yours truly,

XXXX

Encl.

Occupational Accident – Injury – Illness Control Program

Date:

Company Name:

Address:

City:

Postal Code:

Telephone:

Attention:

1. Do current record-keeping procedures categorize injuries by type and related job or operation?
e.g. tendinitis right shoulder – Press # 2 operator.
2. List all jobs/operations associated with more than one injury in the past 12 months and indicate the number and type of injury for each.
Describe procedures used to assess these jobs and investigate these injuries.
Describe the steps being taken to prevent a recurrence of these injuries in accordance with the requirements of Section 5 of Ontario Regulation 692/80.
Describe programs in place to monitor and review the effectiveness of actions taken.
3. Have job safe procedures and physical demands analysis been developed for each job or operation?
Enclose example of each.
4. Describe training programs and procedures currently in place pertinent to soft tissue injuries (i.e. repetitive strain injuries and back injuries).

Company Name:

Address:

City:

Postal Code:

Attention:

Are training programs documented and records maintained for review by the inspector?

Do you require further assistance? Explain.

Completed by:

Management Representative (title)

Worker Representative

Gerry Goldberg, PhD,

C. Psych.

Pauline Klaas

Identification and Management of Depression in the Workplace

Summary

This paper reviews the prevalence of depression in the workplace and its costs to employers and workers. Guidelines for identifying the symptoms of depression and the side effects of drugs for depression are provided. These guidelines help alert supervisors to problems that may render a worker unfit for work or in need of modified work. Guidelines for the supervisor's limited role in dealing with a depressed worker are also provided. A review of workplace factors that may contribute to depression is presented, with suggestions for avoiding potential problems.

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Prevalence of Depression in the Workplace

Depression strikes most people at one time or another, to the extent that it is often referred to as the 'common cold' of mental illness. Depression varies in form and severity, from feelings of sadness and minor disappointment to symptoms sufficient to require hospitalization. At least 10 per cent of the Canadian population suffers from depression severe enough to seek help from a professional.¹ By age 55 about 40 per cent of men and 70 per cent of women experience a major depression. The lifetime prevalence of depression for males and females is represented in Appendix A. Another 20 per cent of Canadians experience serious depressive symptoms for which help is never sought.

A National Safety Council report² on depression states that depression is the third most common health problem in the United States. This report states that at any one time 6–10 per cent of any work force suffers from it; in the United States alone, depression disables more than ten million workers each year. The report also points out that the rate of depression is rising. A large study conducted at a Westinghouse plant found that 16.6 per cent of female and 8.6 per cent of male managers were clinically depressed. Many of these workers take antidepressive drugs to control their illness. Other studies have shown that ten workers per thousand are on depressive medications.³ Both depression and the side effects of drugs used to combat it are a problem that needs to be addressed to ensure workers are fit to work. Depression and the side effects of drugs can render workers unfit to work, or they call for modified work. Often, however, supervisors are unaware of these problems.

Costs of Depression

Key Words:
depression,
psychological,
psychiatric, EAP,
mental health, safety,
behavioural

Over 75 per cent of the total costs of depression to society are not direct-treatment costs but, rather, costs incurred as a result of lost productivity. Some of the costs of depression are general costs to society, but many are specific to industry. It is estimated that in 1980 the costs of depression in the United States, direct and indirect, were \$16.3 billion.⁴ A U.S. study estimated that depression-related absenteeism, lost wages, hospital costs, medication and suicides would cost the U.S. economy \$36.9 billion in 1990 alone.⁵ In the United Kingdom, mental illnesses, including depression, accounted for 61 per cent of work absences. Further, the rate of job turnover was twice as high for depressed employees relative to those employees who were not depressed.⁶ Benefits covering mental illness represent one of the most rapidly growing costs to organizations, and depression accounts for the largest part of this cost. For example, IBM's mental health benefit plan, covering 208,000 employees and 442,000 dependants, in 1980 cost \$26.6 million.⁷

There are also costs to the workers when a person is depressed. Depression is related to increased accidents, suicide and heart disease, as well as to general deterioration in quality of life. Suicide is the second most common cause of death among Canadians between the ages of 15 and 39. Depressed people are often prone to suicide: about 10–15 per cent of the clinically depressed commit suicide. In 1987, 1,046 suicides were reported in Ontario, and it is believed many more went unreported. Sixty per cent of suicides are attributable to a pre-existing depressive illness.⁸

Depression also contributes to worker morbidity in other ways. One study demonstrated that major depression was a better predictor of serious cardiovascular problems in the coming year than was smoking or coronary artery disease.⁹ In a longitudinal age-controlled study, work satisfaction

and happiness were found to predict longevity better than any health or physical-activity factor.¹⁰

Depression affects the general well-being of workers, their families and their coworkers in many ways. It is associated with increases in drug use,¹¹ increases in frequency and severity of various physical symptoms, and a breakdown in marital and other interpersonal relationships.

Coyne¹² reported that those who spoke to depressed people became depressed themselves. This problem has an obvious effect on workplace morale and productivity as well as on the depressed individual. Since people tend to avoid those who are depressed, workers who are depressed often do not receive social support when they need it the most.

When people are depressed, they are at a high risk of accident and injury.² Symptoms of depression, such as drowsiness and anxiety, make workers susceptible to costly errors and accidents.

Clearly, depression is costly to both industry and workers. To avoid these costs and protect workers, supervisors and health and safety professionals need to be able to identify workers who are depressed and in need of help as well as those experiencing the side effects of treatment. Early recognition and intervention are the most effective weapons against the risks associated with depression. Beyond recognizing the problem, managers and most health and safety professionals have an important role to play in intervention. This role is limited, since they should not make a diagnosis. However, where there is concern regarding a worker's performance or fitness for work, they should initiate a process that can protect and help the worker.

Outlined in the following sections are ways of identifying potentially depressed employees as well as those employees who are experiencing the side effects of drug treatment for depression. The next section will review what supervisors can do should they suspect that a worker is unfit for work or in need of modified work. That section is followed by a review of workplace factors that may contribute to depression and includes suggestions for reducing the negative impact of these factors.

The term depression refers to a mood disorder. Severe forms of depression can be divided into three groups. The first of these is major depressive disorder, which is mainly characterized by a blue feeling or a sad mood. The second is known as atypical depression, which often follows short-term symptoms of another major illness. The last type, dysthymic disorder, is longer lasting and is characterized by a sad mood accompanied by more general personality problems. Severe depression can require long-term use of antidepressants, hospitalization, electroconvulsive therapy and/or support counselling. Of the 35 per cent of the population who suffer from depression, 10 per cent are affected by these more serious categories of depression. These forms of depression are generally easier to identify than are the milder forms. (Another type of severe depression is bipolar depression, which occurs in people who are manic-depressive. The depressive symptoms are similar to those of major depression and can be identified in the same way. The manic phase is completely different and requires very different management.¹⁹ Therefore, bipolar depression will not be dealt with in this paper.)

The most common form of depression is known as mild depression. It includes less severe forms of depression, where the criteria of the more severe forms are not satisfied. Thirty-five per cent of the population experience at least mild depression.¹⁹ Sufferers of mild depression respond best to antidepressants, anti-anxiety drugs and/or supportive counselling, and most are treated on an outpatient basis. Since these are the people who would be found within the workplace, they are the ones with whom this paper is most concerned. Depression is a progressive illness, which if left untreated can develop into more severe forms and, consequently, place workers at greater and greater risks.

How Can a Depressed Employee Be Identified?

Some people are more susceptible to depression, including women, younger persons and persons who have just experienced personal traumatic life events.¹³ – ¹⁶ Women are twice as likely as men to suffer from depression. Women whose husbands have been laid off are much more vulnerable to depression than other women are.¹⁵ The rate of depression is very high in people who have experienced accidental injury.¹⁶ Depressed people experience significantly more traumatic life events than those who are not depressed, and they also are involved in significantly more accidents.¹⁴

Below are checkpoints for identifying a depressed employee. Depression can manifest itself in one's appearance, actions and speech. Common activities may change, or the employee may make tell-tale comments that suggest he or she is depressed. Actions and words are often calls for help. Having one of these symptoms does not mean the employee is depressed, but the more of these symptoms a worker exhibits, the more likely it is that depression exists. If one of these symptoms is identified, supervisors and employees should look for more symptoms and perhaps ask the questions indicated below to see if the potentially depressed worker responds in a manner typical of depressed persons. *Again, supervisors and managers should not attempt to diagnose the problem as depression, but they may require that a worker go to a health professional to ensure that he or she is fit for work.*

Mask of Depression: Depression is marked by an overall sad appearance or gloomy expression that is often easy to recognize, especially when talking to the person. When asked how he/she is feeling, the worker may respond, 'I'm feeling kind of down lately.' Or, 'I don't know, a little sad but I don't know why.'

Drowsiness at Work: Depression disrupts sleep patterns quickly. A depressed person can't sleep or sleeps restlessly, and so he or she constantly will appear tired. A typical response to a question

about this drowsiness might be, 'I'm going to bed early but I can't sleep.' Or, 'When I wake up I have a lot on my mind.'

Lack of Energy at Work: Depressed workers will have an overall appearance of weariness. In the early stages of depression the worker will often comment, 'I just don't have much energy lately.'

Eating More or Less than Usual at Work: There is often a marked decrease or increase in appetite and weight in depressed people. They will bring or buy their lunch as usual, but fail to eat it. When asked about this, they may remark, 'I haven't had much of an appetite lately.' Or, 'I'm not really hungry but I just can't stop eating.'

Frequent Absences Due to a Variety of Vague Physical Symptoms: Vague physical ailments, such as problems with stomach and bowel function, chest pains, and headaches, are common among depressed individuals. Generally, these result in frequent absences. If asked if there is a problem, the depressed employee might say, 'I just haven't been feeling well lately.'

Hostile or Impatient Behaviour: Depression may be accompanied by fluctuating feelings of anxiety, tenseness and nervousness. These symptoms often manifest themselves as hostile behaviour and impatience; for example, the use of unnecessarily harsh language or frequent comments like 'hurry up!' or 'get out of my way!'

Medication or Substance Abuse: The many bothersome feelings that depression instils may cause the regular use of alcohol, tranquillizers or other drugs. Look for any of the signs of alcohol abuse or drug abuse (e.g. the smell of alcohol or the dilation of the eyes).

Comments Implying Self-Doubt: Depressed people will constantly criticize themselves. They will make comments like, 'I know the boss won't like my work.'

Excessive Day-Dreaming or Trouble Concentrating: Depression impairs a person's ability to concentrate for extended periods of time. The employees may often not hear what people are telling them, and, so, often ask others to repeat what they have said.

Decreasing Quality of Work: The depressed employee will make a large number of small errors because of an inability to concentrate for long periods of time.

Difficulty Making Decisions: Motor and thinking processes are often impaired by depression, so that the employee may find it hard to make even simple decisions. The depressed employee tends not to make any committed decisions. When asked a question, a depressed person often goes to others to seek approval for a decision or to ask for an opinion. If asked to work overtime, the person might say 'I'm not sure' and then ask someone else's opinion.

Signs of Increased Risk of Suicide: There are a number of signals to look for that suggest an employee is suicidal. These include:

- intense and constant unhappiness with either one's work or one's disability;
- a sense of hopelessness about the possibility of change or an attitude of negative anticipation;
- the absence of significant support systems or the alienation from existing support systems such as family and friends;
- a breakdown of or decrease in communications between the worker and his or her support network (coworkers, supervisors, etc.);
- the use of more than moderate quantities of alcohol or depressing drugs; and/or
- talk of suicide.

It is important to be able to identify the side effects of drugs taken by the depressed employee since they may render the employee unfit for work or in need of modified work. Technically, it is up to the examining physician to inquire about and decide whether the employee is fit to work or modified work is necessary. However, physicians, such as a family doctor, often fail to ask or are not in a position to understand the demands of a client's work and, thus, fail to pass on relevant information about a worker's condition to supervisors. Certain drugs used to treat depression can result in side effects that influence performance and safety at work. The following is a list of side effects that indicate an employee may be on medication:

- tremors and muscle twitches;
- signs of dizziness or loss of consciousness, especially after a postural change;
- general confusion and memory problem—signs of rechecking things that have already been done or difficulty following orders;
- squinting and signs of blurred vision;
- extreme signs of fatigue and drowsiness on the job;
- inappropriate behaviour, such as excessive horseplay or overreacting to others, and signs of hyperactivity;
- a rash (in a number of cases);
- complaints of excessive sweating;
- complaints of vague disturbances such as headaches, nausea, irregular heartbeat and/or frequent aches and pains;
- frequent absences due to the above vague disturbances.

If any of these symptoms is noticed, it is a sign that the employee should see a doctor and get a form stating whether he or she is fit for work, unfit for work or in need of modified work. For a listing of the most common drugs used to treat depression, their brand names and their adverse side effects, see Appendix B.¹⁷

What Management Can Do

Any action taken by management should be based on an observation and evaluation of the employee's job performance or the evaluation that the employee is unfit to work safely. If a worker exhibits any of the behaviours or symptoms of depression or of the side effects from taking drugs that suggest the employee is unfit to work, the supervisor can insist the employee get a medical examination and then present a medical form stating the worker's fitness to work.

A supervisor may note symptoms of depression and then talk to the employee (before a performance problem develops) and suggest he or she get help. A supervisor can ask the employee if there is a problem. If the employee denies that there is a problem, the supervisor can check for decreases in performance and then inform the worker about the diminishing productivity and/or concerns about a possible health and safety risk. The supervisor may also suggest that the employee seek help from the occupational health professional or be made aware of the consequences of not improving performance. If the employee agrees to seek help, the supervisor, employee-assistance contact person or other designated person should help the employee find the appropriate assistance.

If the need for help is denied, progressive discipline may be implemented. The supervisor should remind the employee of his or her option to seek help for the problem each time a new disciplinary action is taken.

Does the Workplace Contribute to Depression?

The workplace factors may contribute to depression and suicide. The Workers' Compensation Board has granted awards in cases where it can be proven that the workplace has contributed to the mental illness. There are also civil cases in which workers have won damages from employers. A number of court decisions have ruled that employers were liable for damages in cases of mental illness and suicide. These cited

such factors as understaffing, heavy workloads and tension.¹⁸

Employers can help reduce the incidence of depression and suicide in the workplace by preventing situations that contribute to their occurrence. The money employers invest in suitable programs can result in both long-term saving and improved worker well-being. This has been demonstrated by companies such as Firestone Tire and Rubber, which calculated savings of \$1.7 million or \$2,350 per person involved. United Airlines reported a return of \$16.35 for each dollar the Employee Assistance Program (EAP) cost. These programs also have favourable effects on employee morale, productivity and job satisfaction.⁶

Below are some workplace factors that may contribute to increased risk of depression and suicide. Some approaches to dealing with these potential problems are also suggested.

The Depressive Behaviour Itself

Depression can cause a breakdown in communication because depressed people are less liked by coworkers and people are less willing to interact with them. This in turn contributes to depression, because depressed workers do not get the support they need.¹² It seems that when people interact with a depressed person, the depression is often transferred to the non-depressed person.¹⁹ This has significant implications for companies: if more workers become depressed, then productivity decreases and general attention to safety hazards decreases. To avoid this situation, management needs to identify and deal with depressive symptoms as soon as possible. Management can also identify and deal with the problems that result from medications. People can be taught to understand and recognize the impact of their coworker's depression upon their own behaviour and feelings. This will help workers to provide their coworkers with the social support they need as well as help avoid a contagion of depression within the workplace.

Particular Toxic Agents at Work

Certain toxic agents have been associated with depression. For example, welders exposed to aluminum were more likely to report problems with depression.²⁰ Employers should ensure that they are adhering to the WHMIS legislation as well as seek out possible exposures that put workers at risk.

A Poor Person-Job Fit

If the employee's temperament is not suited for the job or if the person's personality does not parallel his or her position, he/she will be unhappy, will perform poorly and will be at an increased risk for depression. Persons in jobs that do not fit their temperament have higher morbidity rates than those whose temperaments do fit their job.¹⁰ Employers should ensure that persons have not only the skills necessary for positions they are to fill but also a temperament that matches the position. Employees should be encouraged to discuss problems they encounter in their jobs informally and, at times, with a counsellor.

Work Conditions Resulting in Cumulative Strain

Job demands that extend well beyond the capacities of workers can contribute to depression. Horovitz¹⁸ documented a case of a man who worked 16 to 18 hours a day and who became severely depressed because of resulting tension.

Working conditions or coworkers can cause an employee to experience cumulative stress and tension, which can lead to depression, especially if the worker feels helpless about remedying the situation. Drugs and alcohol are often used to alleviate stress but only serve to increase the risk of depression. Stress-management programs can be implemented. Ergonomics can be evaluated and updated. The stress of coworkers can be reduced if good communication between worker and supervisors is developed, perhaps through communication skills courses. The joint health and

safety committee can play a role here in identifying stress- and strain-related problems early and helping to resolve them.

Changes in Working Conditions and/or Work Relationships

Changes, especially those that are unforeseen, such as increased or decreased responsibility, going on disability pay, reorganization and policy changes, can contribute to depression. This is especially true if the employee thinks the change will have negative consequences and is left feeling powerless or unable to control his or her fate.

Even a promotion can cause stress. The newly promoted worker may experience feelings of inadequacy as well as feelings of guilt or anger because he or she feels alienated from coworkers. Those who are given added responsibilities could be given interviews after their promotion to ensure they are properly suited to the job. Counselling could be offered for any problems the employee encounters.

Relocation or Other Uncertain Circumstances

When an employee is informed of a relocation or layoff, he or she experiences a loss of control, personal relationships and social support systems. Such changes remove employees from a familiar situation and place them in one filled with uncertainty. The people who usually helped the employee are no longer there and the employee may find it difficult to cope. Transferred or relocated employees should be helped through the phases of the move. There are organizations now that provide relocation seminars, interviews and counselling to help deal with the problems associated with moving. The risk of depression in employees who are laid off or dismissed can be decreased if sufficient warning is given, allowing for greater control over the situation, and if support systems (e.g. counselling) are provided to help them deal with the situation.

Conclusions

Six to 10 per cent of any given work force suffers from depression. Depression in the workplace costs the Canadian economy billions of dollars a year. Depression and the unacknowledged use of drugs to deal with depression can have serious health and safety implications, resulting in increased accidents, illnesses, suicides and breakdowns in family and personal relationships. This paper provides a checklist of the symptoms of depression that manifest themselves in the workplace and helps identify the side effects of drugs that supervisors can detect. It advises supervisors regarding their role in both ensuring that workers are fit to work and helping workers get the help they need. Workplace factors that may contribute to depression are reviewed with suggestions for avoiding potential problems.

Résumé

Les auteurs examinent la prévalence de la dépression au travail et ses coûts pour les employeurs et les travailleurs. Ils donnent des lignes directrices sur l'identification des symptômes de dépression et sur les effets secondaires des médicaments antidépresseurs. L'objet de ces lignes directrices est d'aider à sensibiliser les superviseurs aux problèmes qui peuvent faire qu'un travailleur ne soit plus prêt à faire son travail ou ait besoin de tâches modifiées. Les auteurs fournissent aussi des lignes directrices sur le rôle limité du superviseur pour traiter avec un travailleur déprimé. Ils présentent un examen des facteurs professionnels qui peuvent contribuer à la dépression et formulent des recommandations pour éviter les problèmes potentiels.

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Appendix A

Lifetime Prevalence Rate (%) of Major Depression, by Age and Sex

<i>Age</i>	<i>Males</i>	<i>Females</i>
20	3	5
25	7	20
30	12	28
35	17	36
40	20	40
45	25	47
50	30	57
55	34	65

Source: Bromet EJ, Blane H, Curtis CE, Dew AM, Dunn LO, Parkinson DK, Phelan J, Schulberg HC, Schwartz JE. The epidemiology of depression and alcohol abuse/dependence in a managerial and professional work force. (Unpublished manuscript to appear in *J of Occup Med*.)

There are many different drugs available for the treatment of depression. Antidepressants are the main category of drugs used to control the symptoms of depression.

Tricyclic Antidepressants

amitriptyline (Elavil, and others)
amoxapine (Asendin, and others)
clomipramine (Anafranil)
desipramine (Norpramin, and others)
doxepin (Adapin, and others)
imipramine (Tofranil, and others)
nortriptyline (Pamelor, Aventyl and others)
protriptyline (Vivactil)
trimipramine (Surmontil, and others).

Side Effects

Frequent: Anticholinergic effects;* hypotension (less with nortriptyline); drowsiness; weight gain; tachycardia

Occasional: Mania; psychosis; tremor; first-degree heart block; other ECG abnormalities; rash; sweating; confusion; insomnia; sexual disturbances, especially with clomipramine; increase in dental caries; gingivitis

Rare: Hepatic toxicity; tinnitus; bone marrow depression, including agranulocytosis; seizures; peripheral neuropathy; severe cardiovascular effects in patients with cardiac disease; photosensitivity; dysarthria; stuttering; withdrawal symptoms; nausea, tremor, anorgasmia and seizures may be more common with clomipramine; tardive dyskinesia and neuroleptic malignant syndrome with amoxapine; renal failure with overdosage of amoxapine.

* Dry mouth, mydriasis, cycloplegia, urinary retention, decreased GI motility, tachycardia, memory impairment and, in high doses, delirium.

MAO Inhibitors

isocarboxazid (Marplan)
phenelzine (Nardil)
tranylcypromine (Parnate)

Side Effects

Frequent: Hypotension; restlessness; insomnia;
daytime sleepiness

Occasional: Mania; urinary retention; tremors;
sexual disturbances; paresthesias; dry mouth;
nausea; constipation; anorexia; weight gain; edema

~ Rare: Rash; hepatitis, tinnitus; muscle spasm;
lupus-like reaction; leukopenia; hyperthermia;
hypertension.

Others

- bupropion (Wellbutrin)

Side effects: Frequent: Anxiety; agitation; insomnia;
tremor; anorexia. Occasional: Seizures (dose-related).

- fluoxetine (Prozac)

~ *Side effects:* Frequent: Nausea; nervousness;
headaches; insomnia; sexual dysfunction
(anorgasmia). Occasional: Akathisia; rash; fever;
arthralgia; mania; aminotransferase elevations; abulia;
alopecia. Rare: Extrapyrmidal reactions; seizures in
patients with pre-existing seizure disorder;
leukocytosis; bradycardia with syncope; respiratory
distress.

- maprotiline (Ludiomil, and others)

Side effects: Similar to tricyclics, but seizures occur
more frequently (especially with more than 200
mg/day) and anticholinergic effects may occur less
frequently.

- trazodone (Desyrel, and others)

Side effects: Frequent: Drowsiness; headaches;
gastrointestinal upset. Occasional: Ventricular
arrhythmias; peripheral edema. Rare: Priapism in
men; increased libido.

Mesothelioma: Mirthless Musings About a Mysterious Malignancy

Summary

Mesothelioma, a tumour of the mesothelial cells, is a diagnostic oddity about which a number of observations are made. Although the population at risk includes those exposed to asbestos, it is noted that the tumour may occur without exposure. Some recent Ontario statistics are given.

Key Words: asbestos, asbestosis, fibre, mesothelioma, pleura, tumour

Introduction

Mesothelioma is the name of a bizarre tumour of the mesothelial cells, which line the body cavities. Any body cavity may become involved, most frequently the pleural or peritoneal cavities, but also the pericardium and the tunica vaginalis testis. Malignant mesotheliomas are relatively rare. In the general population, the incidence is about one–two per million per year, and in populations not exposed to asbestos, the distribution between sexes is almost equal.¹ In industrialized countries it is two to five times higher. In some shipyard communities and in workers from asbestos factories the incidence rises steeply, to 20 fold or more.²

History

The tumour was first described in 1870 by Wagner,³ who correctly distinguished the encasement it produced from similar changes seen with other conditions such as tuberculosis, then in its heyday. More than half a century later, Robertson⁴ flatly denied the existence of primary tumours of the mesothelium and attributed the sometimes spectacular findings to chronic irritation from pleural and peritoneal effusions or to metastatic deposits. Other investigators, notably Klemperer and Rabin⁵ in 1931, suggested that these tumours were real mesothelial neoplasms. However, the controversy persisted, and as late as 1967 Willis⁶ was siding with Robertson. In 1960, Wagner, Sleggs and Marchand⁷ reported 33 cases of malignant mesothelioma and attributed the tumours to environmental effects of asbestos in the North–Western Cape Province of South Africa. Furthermore, the authors of that paper

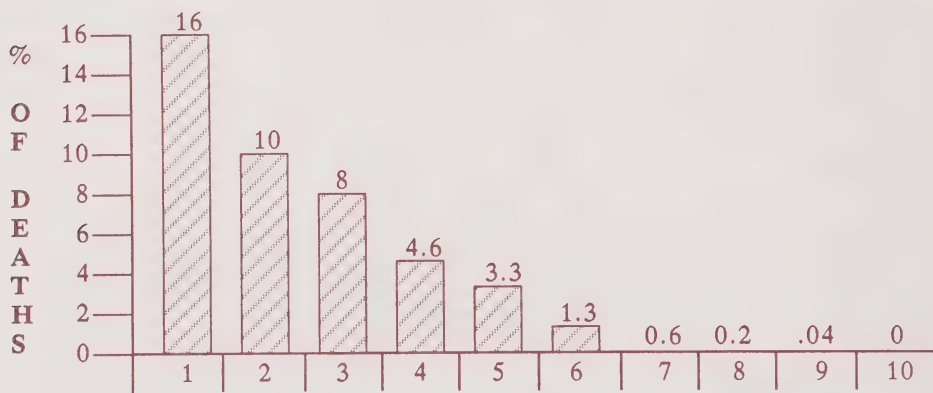
W.M. Maehle, MD,
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indicated that although contact with asbestos was of paramount importance in subsequent development of the tumour, there was no clear dose-effect relationship between the two.

The Wagner, Sleggs and Marchand report was followed by a veritable avalanche of publications from other workers wherever asbestos was used. Thus, when McDonald and McDonald⁸ published their universally acclaimed paper in 1977, they were able to collect over 4,500 cases from 22 countries. Figure 1 illustrates graphically the mortality rates due to mesothelioma for various asbestos-exposed population groups.⁹ Figure 2 is a diagrammatic presentation of the growth of the asbestos industry, related to the prevalence of associated diseases, including malignant mesothelioma.⁹

Figure 1

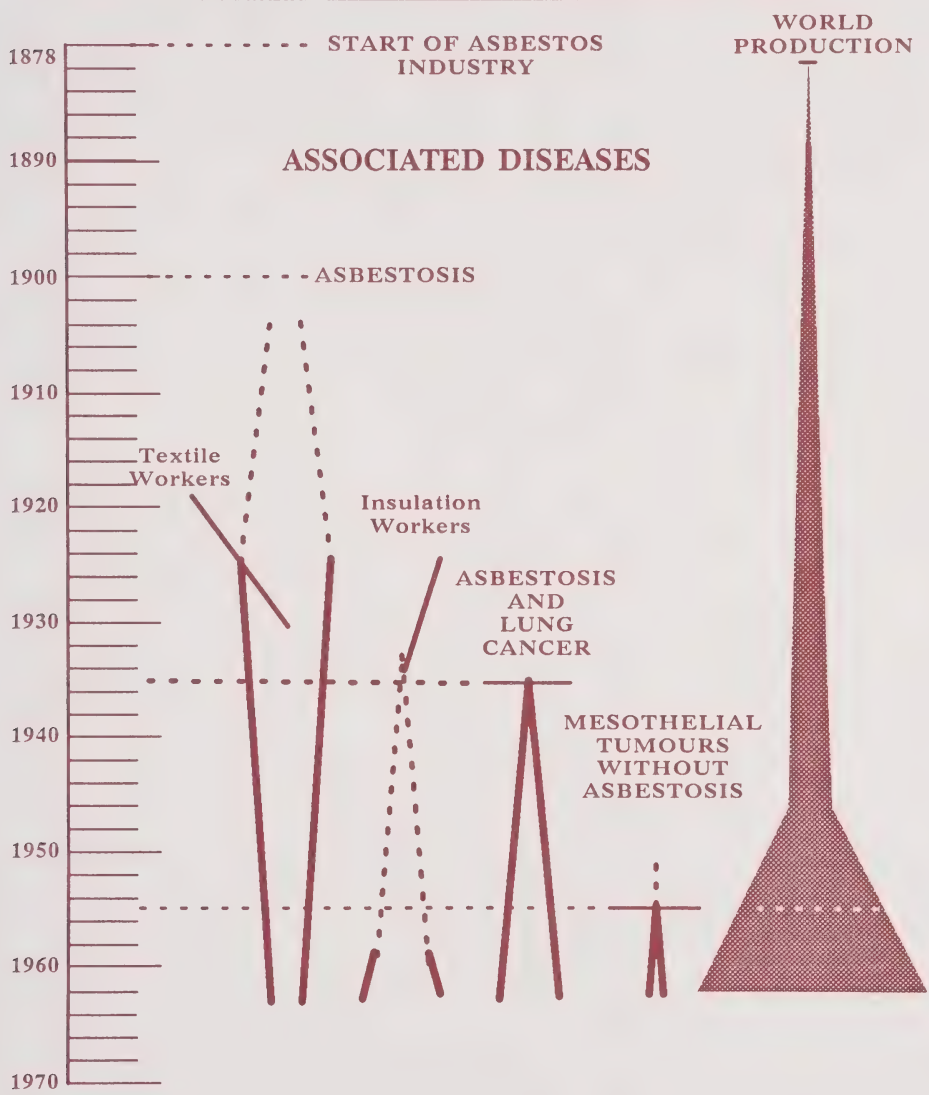
Per cent of Deaths Due to Mesothelioma in Various Asbestos-Exposed Populations



- 1 & 2 = Crocidolite gas masks Can + UK
- 3 = Amosite insulation
- 4 = Amosite factory
- 5 = Crocidolite miners
- 6 = Chrysotile/amosite textile
- 7 = Crocidolite/chrysotile factory
- 8 = Chrysotile miners
- 9 = Chrysotile textile
- 10 = Anthophyllite

Figure 2

Growth of Asbestos Industry Related to Prevalence of Associated Diseases



Asbestos is a term applied to six naturally occurring silicate minerals exploited commercially for their physical properties derived from their fibrous structure. Known in antiquity, asbestos resists heat, acid and friction, and in addition is easy to process. There are two varieties of asbestos:

1. Serpentine: Chrysotile or white asbestos (curved fibres).
2. The amphiboles (straight fibres):
Crocidolite (blue asbestos)
Amosite (brown asbestos)
Tremolite
Anthophyllite
Actinolite.

Chrysotile constitutes 95 per cent of commercially used asbestos, and Quebec is one of its major producers in the world. Crocidolite asbestos is produced in South Africa and Western Australia, and anthophyllite is extracted in Finland. Amosite deposits are widespread in South Africa, whereas tremolite and actinolite are found throughout the world but are of little commercial interest.

The uses of asbestos are many, e.g. heat insulation, electrical insulation and the manufacturing of friction materials. Non-occupational risks involve residents near asbestos-processing plants, personnel living and working near roads on which asbestos is trucked, inhabitants of dwellings with asbestos insulation, and people sharing accommodations with asbestos workers. What had readily become apparent was the existence of a definite gradient of risk, in terms of oncogenicity for mesothelioma, with respect to the different fibres used commercially. Crocidolite and amosite top the list as most dangerous, and anthophyllite occupies the bottom position. McDonald and McDonald⁹ did not completely exonerate chrysotile of mesothelioma-inducing potential. They felt, however, that the fibre load required would have to be much greater

than with other forms of asbestos. The last point should be of some interest to all Canadians, since Canada remains one of the world's largest producers of chrysotile.

Of even more interest is the work of Pooley¹⁰ and of Newhouse et al.,¹¹ who feel that exposure to chrysotile alone will not lead to mesothelioma. Pooley¹⁰ and Wagner¹² have documented that chrysotile deposits are frequently heavily contaminated by tremolite, and that particular amphibole has a marked propensity for inducing mesothelioma in experimental animals.

Population at Risk

The population at risk for developing mesothelioma includes:

- all occupations having direct contact with asbestos;
- workers in other occupations who work or have worked in areas where asbestos was used by others;
- household contacts of asbestos workers;
- individuals residing within a radius of 1–2 km from an asbestos plant, shipyard or other source of asbestos contamination.

The population at risk must include all persons who have been exposed to asbestos, however briefly, during the past 35–40 years.

Pathogenesis of Mesothelioma

While the pathogenesis of mesothelioma is not yet understood, the following observations can be made:

- mesothelioma may result from exposure to crocidolite, amosite or tremolite asbestos;
- relatively low-level and brief exposures can produce mesothelioma;
- while a dose-response relationship may exist, it has not been quantitatively clarified, which in practical terms means that any asbestos exposure has to be regarded as potentially significant;
- cigarette smoking has no etiologic relationship with mesothelioma.

To complicate matters, we cannot explain all cases of mesothelioma purely on the basis of exposure to asbestos. It has been reported in children,¹³ and there has been no apparent history of exposure either directly or indirectly in the majority of such cases. A survey of 22 papers from 10 countries reveals the following:

Exposure to asbestos in mesothelioma cases:

Occupational exposure	50%
Para-occupational exposure	19%
No known exposure	31%

Does asbestos have fibrogenic and oncogenic effects only when taken through the respiratory system? It is, after all, a natural substance, and there are many asbestos fibres in the environment, some of which are digested through food and drink. Electron-microscopic studies carried out on municipal water in Canada and the United States detected between one million and 173 million asbestos fibres per litre.¹⁴ Asbestos fibres were found in beer.¹⁵ Nicholson and his colleagues¹⁶ demonstrated the presence of asbestos fibres in some parenteral medicines such as ampicillin, neomycin and tetracycline hydrochloride. To confuse things further, mesotheliomas have been developed in experimental animals with plutonium,¹⁷ beryllium¹⁸ and other carcinogenic materials. An accidental contamination of the peritoneum with thorotrast, during surgery on the biliary tract, was the apparent cause of peritoneal mesothelioma 30 years later.¹⁹

Diagnostic Criteria

The turbulent history of this nosological entity was largely due to the complexities and difficulties of the pathologic diagnosis. The diagnostic criteria for pleural mesothelioma include the following:

- history of asbestos exposure in the past;
- long latency period (20–40 years) from exposure to onset of symptoms;
- clinical symptoms, usually unilateral chest pain and /or dyspnea developing over a short period of time;

- physical findings, usually consistent with pleural effusion;
- radiographic abnormalities presenting as pleural thickening or effusion, often with large nodular opacities projecting from the pleura;
- tissue diagnosis; and
- usually, rapidly progressive and an almost universally fatal clinical course.

There are indications that pleural mesotheliomata have been underdiagnosed in the past.^{20, 21} Attribution of proven cases of mesothelioma to occupational exposure to asbestos remains a highly contentious issue, and not surprisingly so considering some of the difficulties outlined above. Table 1, from the Ontario Cancer Institute, summarizes proven cases of mesothelioma in Ontario. The right-hand column gives the number of cases accepted by the WCB as work-related. Several recent papers by MM Finkelstein^{22, 23, 24} suggest that much occupationally related disease (including pleural and peritoneal mesothelioma) is not being recognized in Ontario.

Conclusions

The primary malignant neoplasm of the pleura, diffuse pleural mesothelioma, has been recognized as a nosological entity only during the past 25 years. Asbestos fibres are widely accepted as the causative agent in the vast majority of mesothelioma cases. Recently other fibres, e.g. naturally occurring zeolites (erionite, mordenite), have come under scrutiny as potential causative agents for malignant mesothelioma. Further research is needed to determine mechanisms of carcinogenicity for zeolites, titanite fibres and man-made fibres. The lowest level of asbestos exposure that may result in mesothelioma has to be defined. Finally, treatment of mesothelioma needs a great deal of improvement, as its current status is most unsatisfactory.

Table 1

Mesothelioma (Ontario)

	Male	Female	WCB
1964	1	0	
1965	6	3	0
1966	5	5	1
1967	7	1	1
1968	8	0	
1969	5	3	1
1970	6	9	1
1971	6	4	2
1972	8	1	0
1973	6	3	5
1974	18	7	3
1975	2	8	5
1976	15	7	1
1977	13	8	3
1978	16	5	7
1979	28	9	7
1980	30	9	12
1981	29	11	4
1982	30	7	24
1983	42	14	15
1984	37	7	8
1985	51	14	12
1986	48	16	16
1987	46	9	19
Total	463	160	147

Résumé

Le mésothéliome, tumeur des cellules mésothéliales, est un phénomène diagnostique qui fait l'objet d'un certain nombre d'observations. Bien que la population à risque inclue les personnes exposées à l'amiante, il est reconnu que le mésothéliome peut se développer sans l'exposition à cette substance. Certaines statistiques récentes pour l'Ontario sont présentées.

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Guidelines for the Assessment of Respiratory Impairment in Silica and Asbestos Exposure

Summary

A guide for making determinations of the degree of respiratory impairment for workers exposed to silica and asbestos dusts is described. Emphasis is placed on pulmonary function tests using forced vital capacity, forced expiratory volume (one second), total lung capacity and diffusing capacity. A flow chart for decision making is provided. The system is of value in helping to make consistent decisions on respiratory impairment.

Key Words: respiratory impairment, disability evaluation, silicosis, silica, asbestosis, asbestos, pneumoconiosis

Introduction

Many of the respiratory disease claims for compensation are for diseases related to silica or asbestos dust inhalation. Determination of the degree of respiratory impairment is often difficult. Also, cardiac and other diseases unrelated to the occupational dust exposure require consideration, as they may make important contributions to the respiratory impairment. The present report is an attempt to provide recommendations that are practical, rational and systematic and are in keeping with current medical opinion. It is intended that the guidelines will be used to provide consistency in these assessments. However, the recommendations are only guidelines, and flexibility must be used in the assessment of each individual claimant.

This paper is not intended as a review of the pneumoconioses or of the numerous publications relevant to assessing respiratory impairment. Rather it is intended only as a pragmatic guide to assist in making specific impairment decisions.

General Principles

Our practical experience has shown that the degree of respiratory impairment is most appropriately graded in steps of 0, 10, 20, 30, 45, 70 and 100 per cent. The intervals are smaller in the lower ranges to provide a degree of flexibility that is less important in the more severely impaired individuals. The steps are also arranged to relate easily to the American Medical Association guidelines for respiratory impairment.

After the degree of impairment has been decided, the portion of the impairment reasonably

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attributable to the occupational exposure is considered.

Based on a review of the literature, the guidelines implicitly incorporate the following conclusions:

- Small amounts of silica in the lungs may not cause fibrosis detectable by radiography or result in abnormalities of pulmonary function even though silicosis nodules may be found at autopsy or on lung biopsy.
- Simple silicosis (nodules in the lungs not exceeding 1 cm in diameter and appearing first in the upper zones but later spreading more widely) does not impair pulmonary function enough to cause more than the normal dyspnea on exertion.
- Complicated silicosis or progressive massive fibrosis (coalescence of nodules to form conglomerate masses) in its early form may not significantly impair pulmonary function enough to cause more than the normal dyspnea on exertion. Advanced complicated silicosis is associated with fibrotic masses, which cause a decrease in lung volume in the upper zones while emphysema develops in the lower zones. This results in an increased overall lung volume with reduced gas flow rates and low diffusing capacity. The pattern of respiratory function abnormality resembles that of emphysema, but the hyperinflation may not be as marked because of the coexisting silicotic fibrosis. Very advanced complicated silicosis may lead to hypoxemic respiratory failure and chronic cor pulmonale.
- Both forms of silicosis, simple and complicated, may be progressive or may remain stable indefinitely, showing no change either radiologically or in the pulmonary function tests. In general, progression is more likely if there is continued exposure to silica dust.
- Small quantities of asbestos in the lungs may not result in any reaction that can be detected by examination, by radiography or by pulmonary function testing, even though

asbestos and asbestos bodies may be found at autopsy or on lung biopsy.

- Pleural plaque formation may occur as the result of many years of light exposure to asbestos. Usually the pleural changes are patchy, and this does not impair pulmonary function enough to cause more than the normal dyspnea on exertion. If the plaques are extensive, this may result in a slight restriction, since the lung volumes may be reduced.
- Pleural effusion may occur after moderate exposure to asbestos over several years. Following its resolution, there may remain diffuse pleural thickening. This does not usually cause a significant impairment of pulmonary function, but if it is extensive a slight to moderate restriction with reduction in lung volumes may be found.
- Pulmonary parenchymal asbestosis (pulmonary fibrosis) may occur after long-term heavy exposure to asbestos. The fibrosis may be minimal and may not impair pulmonary function, but pulmonary parenchymal asbestosis, if advanced, causes reduced lung volumes and a decrease in diffusing capacity. Asbestosis may be presumed present if there are otherwise unexplained basal crackles on chest examination or unexplained basal fine streaking on radiography, or if there is an otherwise unexplained low diffusing capacity in a person with a known exposure to asbestos. Very advanced asbestosis may lead to hypoxemic respiratory failure and chronic cor pulmonale.
- Chronic obstructive lung disease is a feature of advanced complicated silicosis. There is also some evidence that both silica dust and asbestos dust may cause mild small airway obstruction; however, the data suggest that this rarely results in sufficient obstruction to air flow to cause symptoms. In simple silicosis and in asbestosis, the presence of clinically significant obstruction to air flow is usually not due to occupational exposure to silica or asbestos.

Steps in Decision Making

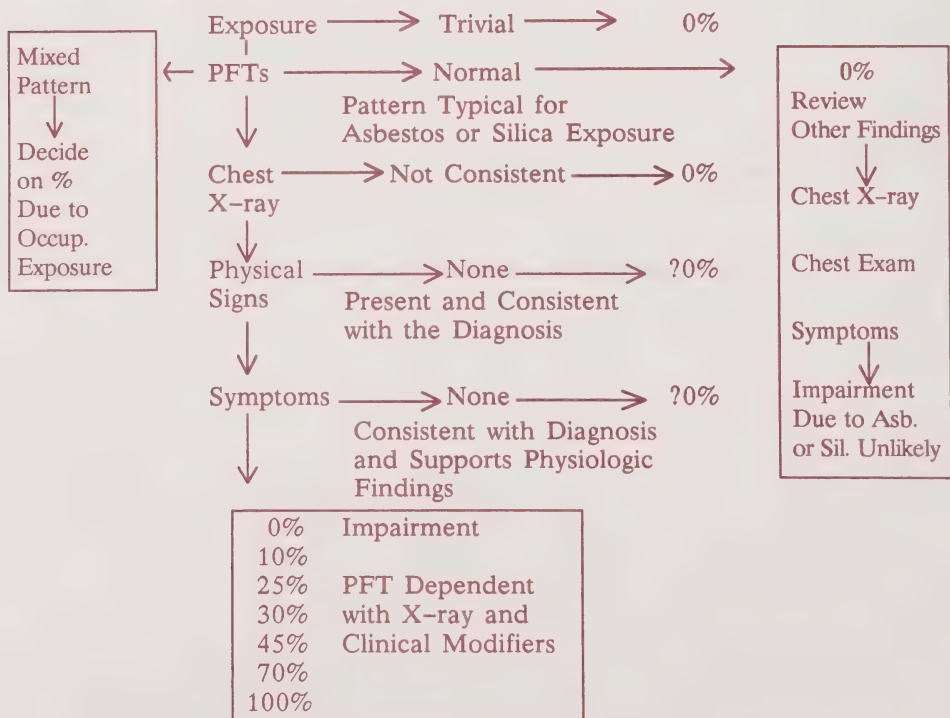
The following steps are suggested as a systematic and practical way to consider the assessment of respiratory impairment.

Step 1

A flow chart for decision making is shown in Figure 1. Establish the degree of exposure to airborne silica or asbestos dust. The worker's duration and intensity of exposure can be estimated using the records or reports of such agencies as the Workers' Compensation Board or Ministry of Labour as well as union records. It can be further detailed by the questioning of the worker and the employer. The data obtained concerning duration of exposure are somewhat more accurate than the information related to intensity of exposure.

Figure 1

Assessment of Impairment



If exposure to silica or asbestos is trivial, any respiratory problems of the claimant are not due to these substances, and the impairment rating due to silica or asbestos should be assessed as 0 per cent. If the assessment relates to workers' compensation, the worker should be referred back to the Workers' Compensation Board for consideration of other work-related causes of respiratory impairment.

If there has been definite exposure to silica and/or asbestos, then proceed to the next step.

Step 2

Review the pulmonary function tests. Every new claimant should have undergone pulmonary function testing, including spirometry, lung volumes and single breath diffusing capacity. The pulmonary function laboratory should have satisfactory quality control procedures.

The system of assessing impairment based on pulmonary function testing, as shown in Table 1, is based on recommendations made by the American Medical Association (AMA) as shown in Table 2. In contrast with the AMA Guidelines, specific percentage impairment ratings are recommended rather than ranges, and this makes decisions somewhat easier. Also, there are different approaches to assessment of respiratory impairment, depending on whether restriction or obstruction is present. This is not considered in the AMA recommendations. For restrictive disease, particular attention should be paid to the vital capacity and the total lung capacity. For obstructive disease, particular attention should be paid to the forced expiratory volume (one second) and its ratio with the vital capacity. Diffusing capacity is important both in complicated silicosis and in pulmonary parenchymal asbestosis.

Arterial blood gases are not used, as these usually show abnormalities only in association with abnormalities in other tests.

Table 1

Guideline to Permanent Impairment

AMA CLASS	% IMP	RE/OB	# FVC	# FEV ₁	@ FEV ₁ /FVC	# TLC	# D _{Lco}
1	0	No abn	>80	>80	>70	>80	>70
2	10	RE	70-79	70-79		70-79	60-69
		OB		65-79	65-69		
	20	RE	65-69	65-69		65-69	55-59
		OB		55-64	60-64		
3	30	RE	60-64	60-64		60-64	50-54
		OB		45-54	55-59		
	45	RE	50-59	50-59		55-59	35-49
		OB		35-44	45-54		
4	70	RE	40-49	40-49		50-54	20-34
		OB		25-34	30-44		
	100	RE	<40	<40		<50	<20
		OB		<25	<30		

RE = restrictive ventilatory pattern

OB = obstructive ventilatory pattern

= expressed as % of predicted

@ = FEV₁ as % of FVC

Ventilatory tests normal predictions are based on reference values by

Crapo RO et al. Am Rev Resp Dis 1981; 123:659-64.

Diffusing capacity normal predictions include relation to alveolar volume and are based on reference values by Gaensler EA and Smith AA. Chest 1973; 63:136-45.

AMA class is based on Guidelines to the Evaluation of Permanent Impairment, 3rd edition (revised), 1990:125.

Table 2

**American Medical Association (AMA)
Guidelines for Respiratory Impairment**

AMA CLASS	%	FVC %	FEV ₁ %	FEV ₁ / FVC %	Dco %	VO ₂ Max ml/ kg min
1	0	>80	>80	>70	>80	>25
2	10-25	60-79	60-79	60-69	60-79	20-25
3	30-45	51-59	41-59	41-59	41-59	15-20
4	50-100	<50	<40	<40	<40	<15

Adapted from Guidelines to the Evaluation of Permanent Impairment, 125.

The maximum oxygen consumption during exercise is used by the AMA, but we believe this test is seldom necessary. Exercise testing should be done in selected situations where limitation of exercise tolerance is experienced due to shortness of breath but the chest X-ray abnormalities are minor and/or the pulmonary function test results at rest are not compatible with the amount of shortness of breath described by the worker. The exercise tests include measurement of arterial oxygen saturation by ear oximetry, minute ventilation, heart rate and oxygen consumption. These tests may be useful in distinguishing cardiac from pulmonary causes of dyspnea. Exercise tests may be helpful in making a decision on working capacity and for making recommendations as to whether the worker can or cannot return to usual previous work.

If there is abnormality in the pulmonary function test results, then determine the degree of impairment by referring to Table 1. Then review all the clinical aspects to determine the portion of the impairment that may be reasonably attributable to the occupational exposure. This requires considerable judgment in that the impairment percentage derived from the table may involve relating several different pulmonary function abnormalities to the clinical information. For example, a worker may have complicated silicosis

with marked obstruction to air flow and a low diffusing capacity, but he or she may also have been a heavy smoker of long duration. The pulmonary function abnormality must then be related to both the silicosis and the effect of smoking, with a determination made as to the portion of the impairment reasonably attributable to the silicosis. If the pulmonary function tests are all normal, then proceed to Step 3.

Step 3

Review the chest X-ray (postero-anterior and lateral views), physical findings and respiratory symptoms in this order. Usually, abnormalities on the chest X-ray, even if compatible with a diagnosis of silicosis, asbestosis or asbestos-related pleural changes, will not alter an impairment assessment of 0 per cent if all the pulmonary function tests are normal. Similarly, abnormal findings on chest examination, such as basal crackles, suggest an anatomical abnormality but, if this is not associated with a functional abnormality, the impairment assessment would be 0 per cent. Respiratory symptoms, such as abnormal shortness of breath on exertion, are not usually due to a pulmonary cause when all the pulmonary function tests are normal. In such situations cardiac or other causes should be sought.

Step 4: Writing the Report

After summarizing the clinical, X-ray and pulmonary function tests findings, the recommendations should be clearly recorded:

AMA Class: _____
Degree of impairment: _____ %
Degree of impairment probably
attributable to silica/asbestos
dust exposure: _____ %
Comments on rationale used in the attribution
of impairment due to non-occupational
chest disease: _____

Such comments should be provided in some detail. It is also useful for the clinician who examined the claimant to comment on the emotional response of the individual to the presence of an occupational respiratory disease, since this may result in an additional award for impairment due to psychological sequelae.

Follow-up

Physicians responsible for the care of such patients might wish to arrange follow-ups as part of good medical care. Rational intervals for follow-up based on the natural history for silica and asbestos exposure-related diseases are recommended (Table 3). Of course, workers may request a follow-up at any time if a change in respiratory symptoms has been noted.

Table 3

Recommendations for Follow-up Intervals

SILICA EXPOSURE

No silicosis	No follow-up
Simple silicosis	
Unstable	2 years
Stable	4 years*
Complicated silicosis**	
Unstable	1 year
Stable continued exposure	2 years
Stable no exposure	3 years

ASBESTOS EXPOSURE

No asbestos-related changes	No follow-up
Pleural changes only	4 years*
Consistent with asbestosis**	
Unstable	1 year
Stable continued exposure	2 years
Stable no exposure	3 years

*Follow-up limited to twice at 4-year intervals up to 8 years after no longer exposed.

**Follow-up continues indefinitely for lifetime.

An important reason for follow-up is to detect changes that might result in a revised assessment of the degree of impairment. If worsening of pulmonary function is noted at a follow-up visit, then a change in impairment assessment should be made in keeping with the recommendations in Table 1. There may be records of pulmonary function tests going back many years. If these show progressive deterioration, this fact should be considered in determining a change in the impairment assessment. It should be noted that worsening of the chest X-ray, in the absence of a significant change in pulmonary function, will usually not affect the impairment assessment. On the other hand, a deterioration of pulmonary function consistent with the natural history of the occupational disease may well lead to a higher impairment assessment even if the chest X-ray remains unchanged.

Discussion

There is currently no ideal system for assessing the respiratory impairment due to silica and asbestos-related diseases. In the present paper, emphasis has been placed on the use of the results of pulmonary function testing done at rest.

The recommendations of the Canadian Thoracic Society Task Force on Occupational Respiratory Disease (Pneumoconiosis)¹ indicate various classes of severity of disease but give no specific impairment percentages. The American Thoracic Society guidelines use tests similar to those in the present paper but describe various classes of severity of disease similar to the Canadian Thoracic Society.² The American Medical Association recommendations have been accepted by many groups, but the difficulty in using ranges and not specifying the type of ventilatory defect has already been discussed.³

There have been many reviews of assessment of respiratory impairment,⁴⁻⁹ and Barnhart⁴ has expressed the problems as follows: '[T]he limitations of the various compensation systems need to be clearly recognised. In the assessment of impairment and disability these include the

absence of a gold standard by which to measure dyspnea, the arbitrary nature of criteria of respiratory impairment, the difficulty of assessing the energy requirements of individual jobs ... '

However, physicians are responsible for making the determinations of respiratory impairment due to occupational chest disease, determinations that are used for compensation and other medico-legal purposes. A set of guidelines that recognizes both the strengths and weaknesses of current diagnostic and clinical procedures is likely to promote determinations that are more consistent and rational than would otherwise be possible. It should be clearly understood that the guidelines presented in this paper are of an interim nature and that these should be replaced by others as better techniques for assessing respiratory impairment become available.

Résumé

Les auteurs traitent d'un guide pour préciser le niveau de handicap respiratoire des travailleurs exposés aux poussières de silice et d'amiante. Ils insistent sur l'importance d'une évaluation de la fonction pulmonaire sur les plans suivants : capacité vitale forcée, volume expiratoire forcé (une seconde), capacité pulmonaire totale et capacité de diffusion. Le guide comprend un ordinogramme décisionnel. Le système est utile pour aider à prendre des décisions cohérentes dans les cas de handicap respiratoire.

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